

San Lorenzo River Sediment Total Maximum Daily Load Comprehensive Monitoring Program

Introduction

The San Lorenzo River was listed for non-attainment of established water quality standards pertaining to sediment under Section 303(d) of the Clean Water Act. Three creeks within the San Lorenzo River Watershed were also listed, including Shingle Mill Creek, Lompico Creek and Carbonera Creek. Section 303(d) requires the State to establish the Total Maximum Daily Load (TMDL) for sediment at a level necessary to achieve/attain the water quality standard for sediment. On May 16, 2003, the Central Coast Regional Water Quality Control Board (Regional Board) adopted Resolution No. R3-2002-0063 to include the San Lorenzo River (including Carbonera Creek, Lompico Creek, and Shingle Mill Creek) Sediment Total Maximum Daily Load (TMDL) in the Regional Board's Basin Plan. The TMDL became effective on December 18, 2003 when it was approved by the Office of Administrative Law.

The TMDL identifies the need to develop a Comprehensive Monitoring Program (CMP) that includes compliance monitoring of numeric targets to determine protection of aquatic life beneficial uses. The CMP calls for the numeric target data to be evaluated in the context of other related information. In addition to the proposed numeric target monitoring, components of the CMP include turbidity, fisheries, and project effectiveness monitoring. The CMP also includes procedures for data management and use.

Regional Board staff in concert with members of the San Lorenzo River Technical Advisory Committee, which includes stakeholders, along with Implementing Parties identified in the TMDL, will annually review the results of data collected as part of the CMP in conjunction with information gained from tracking implementation actions. The primary objective of numeric target monitoring is to determine compliance with the San Lorenzo River Sediment TMDL per the established values to determine when aquatic life beneficial uses (e.g. salmonid spawning and rearing) are protected. A secondary objective is to evaluate the numeric target values to ensure the targets' applicability to the San Lorenzo River Watershed and to verify that the targets show attainment of the TMDL. This will allow for an iterative approach in which the numeric targets are based given the variability of sediment processes.

The San Lorenzo River Technical Advisory Committee (TAC) members identified numerous parameters, some of which are identified in the TMDL Monitoring Plan (CCRWQCB, 2002) that would provide additional information to evaluate protection of aquatic life beneficial uses. These include, but are not limited to the following: suspended sediment, embeddedness, in-stream cover, temperature, canopy, and channel cross-sectional/longitudinal profiles. These and other parameters will be considered and monitored as funding and resources allow. Relevant data will be evaluated as part of the CMP as it becomes available. Every three years (December 2006, and every three years thereafter), Regional Board staff will determine compliance with the TMDL.

Numeric Target Monitoring

The San Lorenzo River Sediment TMDL Monitoring Plan collects data to compare with four numeric targets for stream substrate. The numeric targets were established as part of the TMDL. The TMDL provides a detailed description of the numeric targets.

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Table 1 describes the parameters and monitoring strategies, along with the numeric target values. The primary objective of numeric target monitoring is to ensure compliance with the San Lorenzo River Sediment TMDL by determining when and where aquatic life beneficial uses are protected, particularly those of salmonid fishes (steelhead and coho). The four numeric targets, along with the sampling locations and frequency are discussed below.

Percent Fine and Coarse Fines

Sedimentation is one of the principal factors determining the salmonid survival rate from egg deposition to hatching and from hatching to emergence from the gravel (Shapovalov and Tact, 1954, p. 155). The interstitial spaces between the particles allow for water to flow into the interior cavity where dissolved oxygen, needed by the growing embryos, is replenished. Similarly, the interstitial spaces allow water to flow out of the interior cavity carrying away metabolic wastes. However, fine particles either delivered to the stream or mobilized by storm flow can fill those interstitial spaces, blocking the flow of oxygen into the redd and the metabolic wastes out of it. The reduced permeability of the redd caused by fine particles (> 0.85 mm) results in lower embryo survival. The coarser fines, > 0.85 mm and < 6.5 mm, can impede emergence of fry from the redd thereby reducing survival rates for fry.

Monitoring of fine sediment (fine fines < 0.85 mm and coarse fines < 6 mm) for compliance with this target will be conducted using a McNeil bulk sampler directly applied to potential spawning substrates. Analyzed data provide particle size distributions representative of the area sampled. The sampling protocols are in the Project Report for the Regional Sediment Assessment (2004).

Residual Pool Volume (V^*)

V^* gives a direct measurement of the impact of sediment on pool volume. It is the ratio of the amount of pool volume filled in with fine, mobile sediment, and the total scour pool volume (Lisle, 1993). The protocols for measuring residual pool volume were first defined in Lisle and Hilton (1992). Regional Board staff are modifying the original protocols into a "modified V^* " protocol and will finalize sampling and analytical procedures prior to the commencement of this monitoring program.

Median particle size diameter (D_{50})

The D_{50} is the median value of the size distribution in a sample of surface pebble counts. It is a measure of the central tendency of the whole sample, and thus is one of several indicators of how "fine" or "coarse" the sample is overall. As discussed above, both amount and size of fine and coarse sediments can impact salmonid lifestages. The protocols for measuring median particle size diameter are defined in Wolman (1954) and the Project Report for the Regional Sediment Assessment (2004).

Sample Locations and Frequency

Regional Board staff or contractors will perform numeric target monitoring on all listed waterbodies and at the mouths of tributaries to the mainstream. During TMDL development, Santa Cruz County and Regional Board staff identified 15 stream reaches to be monitored (Figure 1) based on previous fisheries surveys and potential spawning and rearing habitats. Monitoring reaches may be modified (e.g. reaches added in the Upper and Middle San Lorenzo River, and Newell Creek; reach deleted in Shingle Mill Creek) as necessary to evaluate TMDL compliance. Monitoring within the San Lorenzo

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River watershed will occur triennially, beginning in 2006 pending gaining adequate funding. Monitoring will be performed during low flow conditions (after spring rains have ceased, fry emergence, and prior to the start of fall/winter rains).

The greatest challenge in monitoring substrates is identifying the appropriate feature to sample. The numeric target parameters are specific to salmonid habitat requirements (e.g. spawning and rearing habitat), so clear and accurate identification of such features is an essential first step in collecting a representative sample. As such, fisheries biologists are needed to confirm the portions of stream reaches where spawning is known or suspected to occur.

Other parameters may also be monitored to gain a better understanding of the factors affecting the instream habitat pending available funding and resources. These other parameters may also be used as targets in the future if it is determined that they are relevant measures of water quality improvement as it relates to sediment.

Sample Analysis

Bulk samples will be analyzed by dry weight methods at the Regional Board laboratory or other suitable laboratory. Data entry and analysis software are available from the Regional Board for bulk sample, pebble count, and V* data.

Table 1 TMDL Indicator Monitoring.

	Numeric Target	Frequency	Monitoring Locations	Protocol	Implementing Party
Percent fine fines < 0.85 mm in potential spawning gravels.	≤ 21% by dry weight using a McNeil (bulk) sample.	Triennially during low-flow period or, less frequent basis after 3 years if D ₅₀ correlated with % fines.	See Figure 1. In potential spawning gravels.	Central Coast Regional Water Quality Control Board, 2004	Regional Board
Percent coarse fines < 6 mm in potential spawning gravels.	≤ 30% by dry weight using a McNeil (bulk) sample.	Triennially during low-flow period or, less frequent basis after 3 years if D ₅₀ correlated with % fines.	See Figure 1. In potential spawning gravels	CCRWQCB, 2004	Regional Board
Residual Pool Volume (V*).	≤ 0.21 (mean for reach) and ≤ 0.45 (max).	Triennially during low-flow period.	See Figure 1. In qualifying pools	CCRWQCB, 2005 (in progress)	Regional Board
Median particle size diameter (D ₅₀) from riffle crest surfaces.	≥ 37 mm (minimum for a reach) ≥ 69 mm (mean for a reach)	Triennially during low-flow period.	See Figure 1. In potential spawning gravels	CCRWQCB, 2004	Regional Board

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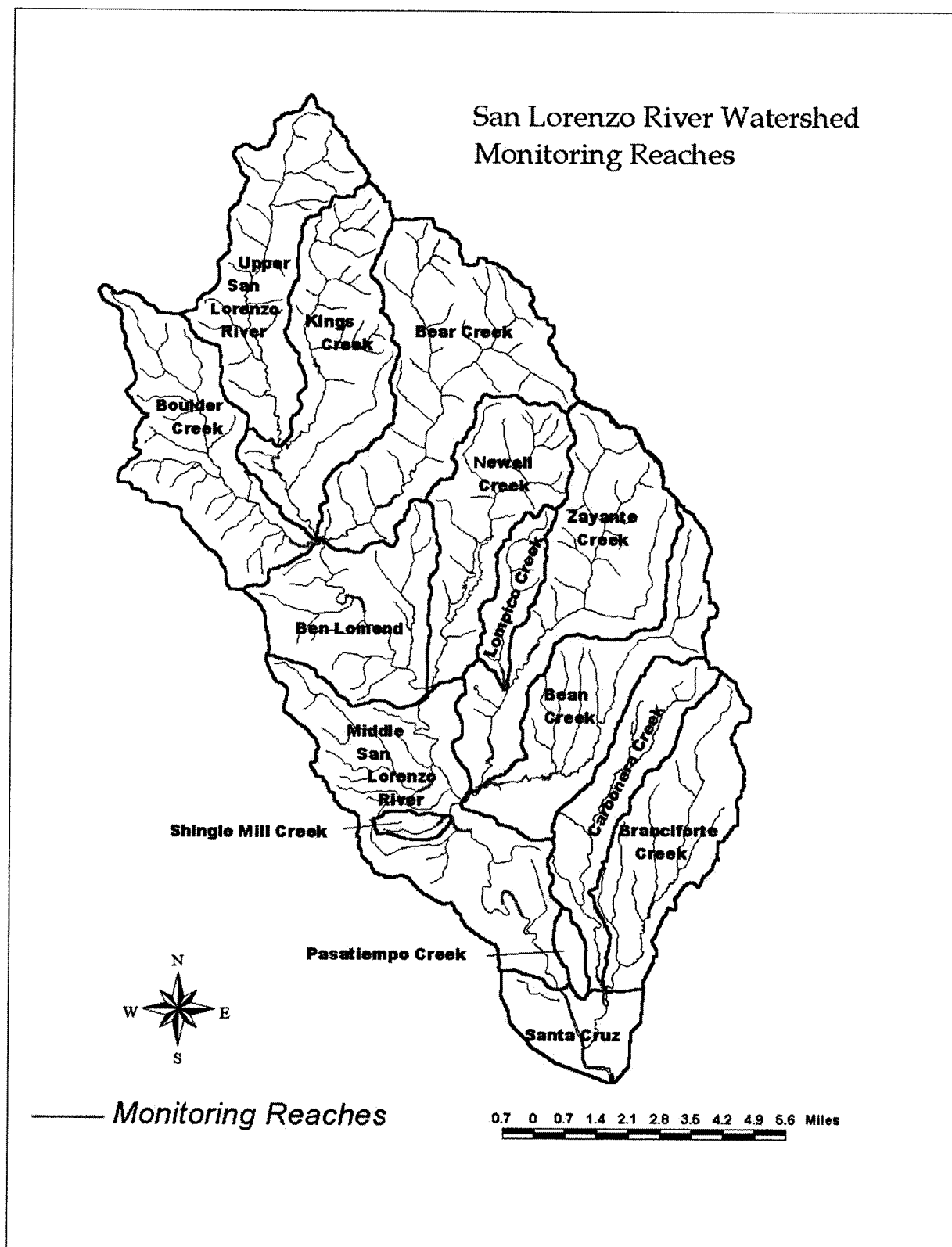


Figure 1. Monitoring Reaches. *Note: reaches may be modified as necessary to evaluate TMDL compliance.*

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Turbidity

The City of Santa Cruz is conducting turbidity trend monitoring to determine if, and to what degree, turbidity impairs the beneficial use of municipal water supply in their operation of water treatment facilities. The City of Santa Cruz operates a continuous reading turbidimeter located at the Tait Street Diversion, just above where Highway 1 crosses the River.

The San Lorenzo Valley Water District (SLVWD) operates continuous reading turbidimeters at three locations in the San Lorenzo River watershed. Turbidity meters are located in Foreman Creek, a tributary to Boulder Creek, and in Clear Creek and Sweetwater Creek, tributaries to the Upper San Lorenzo River. Data collection occurs year-round (except during significant storm-events) to protect drinking water supplies. The SLVWD will research the possibility of long-term data storage and continued collection during storm events.

Together these systems will produce data to characterize the turbidity regime of the San Lorenzo River. Data collected by the SLVWD from the Foreman Creek site (draining a non disturbed area) could also be used to characterize background turbidity levels.

Fisheries

Efforts to monitor salmonid populations are occurring in the San Lorenzo River and other waterbodies within the Big Basin Hydrologic Unit area. D.W. ALLEY & Associates monitored steelhead in the San Lorenzo River watershed in 1994-2001. This included the mainstem and 9 tributaries. In 2002, H.T. Harvey & Associates conducted the monitoring. In 2003 and 2004, D.W. ALLEY & Associates monitored the upper watershed, including the middle and upper mainstem (upstream of the Zayante Creek confluence) and 4 tributaries (Zayante, Bean, Boulder and Bear Creeks). Data have been collected to obtain a more accurate count of the steelhead population and to better estimate an index of adult returns. Monitoring may be reduced due to current funding restraints.

The City of Santa Cruz is conducting endangered species-related monitoring to determine the limiting factors affecting cold-water fisheries and how they are affected by water diversion. Population estimates and habitat surveys are occurring in the San Lorenzo River (primarily Newell Creek), Majors, Liddell, and Laguna Creeks.

The National Oceanic and Atmospheric Administration, Fisheries is currently conducting studies on basic life history traits of salmonids in Scott Creek and its tributaries, a waterbody within northern Santa Cruz County, to determine how these traits might be affected by artificial propagation and environmental conditions.

Project Effectiveness

Project effectiveness monitoring is used to assess whether specific erosion control projects or management practices have had the desired effect. A summary of projects that are or will be collecting project effectiveness data are described in Appendix A.

All federal and state funding for watershed improvement projects, including 319(h) Clean Water Act (CWA) grants, State Revolving Fund projects, and Propositions 13, 40, and 50 require that the benefits and effectiveness of each project be assessed by the project proponent. This information is provided as part of the Project Assessment and

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Evaluation Plan. Similar requirements are attached to the Department of Fish and Game grant programs. Project proponents will monitor specific projects to determine their immediate and medium term on-site effects.

Data Management and Quality Assurance

An approach that leads to the successful assembly and integration of the various data and information requires the development of an organized data management strategy. This process requires involvement from all of the agencies involved with monitoring related to the TMDL, including the following: National Oceanic and Atmospheric Administration Fisheries, California Department of Fish and Game, Santa Cruz County Environmental Health, the City of Santa Cruz, the San Lorenzo Valley Water District, California Polytechnic State University, the California Department of Forestry, and the Regional Board. Since several agencies are monitoring parameter data, a central clearing house is needed for compilation and storage.

Regional Board staff will review numeric target data within 30 days following collection. Raw data will be stored and field notebooks will be archived at the Regional Board office.

Regional Board staff and the other contributors to the monitoring programs will provide data, where applicable, in a format compatible with the Central Coast Ambient Monitoring Program (CCAMP). CCAMP includes data from projects within the Regional Board's jurisdiction (northern Ventura to southern San Mateo counties). The availability of this data provides opportunities for valuable data comparisons between the San Lorenzo River Watershed and other similar areas. This database and selected analytic tools will be available on the Internet as well as linked to the Regional Board website.

Data Use

The numeric target data will be evaluated in the context of progress towards completing the implementation actions and other monitoring data collected as part of the CMP, as part of an iterative approach given the variability of sediment processes. The information will provide a determination as to whether the required reductions in sediment loading are occurring and whether they are having the desired effect on habitat conditions for salmonids in the San Lorenzo River watershed. Specifically, the data will be used to 1) determine when and where aquatic life beneficial uses are protected, 2) to evaluate the numeric target values to ensure the targets' applicability to the San Lorenzo River Watershed, and 3) to verify that the numeric targets show attainment of the TMDL. This evaluation will allow for an iterative approach in which the numeric targets are based given the variability of sediment processes.

Regional Board staff, in concert with members of the San Lorenzo River TAC will annually review data from the CMP and information gained from tracking implementation actions. The TAC will provide a multi-disciplinary perspective of experts including fisheries biologists, hydrologists, and geomorphologists to conduct a thorough and complete evaluation. Every three years, Regional Board staff will determine compliance with the TMDL per the numeric targets and other data collected as part of the CMP, along with the implementation actions per the time schedules established in February 2005. As information is obtained, the Monitoring Plan (including the numeric target parameters and values) and Implementation Plan may be modified through an amendment to the Basin Plan as appropriate.